OPERATION
AND
SERVICE MANUAL

OFFICIAL RECORDS STATION
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FACILITIES

INDUSTRIES, INC.

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PARTS LIST
SCHEMATICS
MARKERS (Optional)

MODEL HD-3

SERIAL NO.

SWEEP GENERATOR

Telonic INDUSTRIES, INC. BEECH GROVE, INDIANA

WARRANTY

TELONIC INSTRUMENTS AND ACCESSORIES

Products manufactured by TELONIC INDUSTRIES, INC. are guaranteed against defective materials and workmanship for a period of one year (vacuum tubes excepted) from date of purchase. This warranty does not apply to instruments that have been altered, improperly handled or damaged in any way beyond our control.

Instruments must be examined immediately upon receipt, since claims for damage in transit will not be honored by the carrier unless prompt action is taken.

CHANGES IN SPECIFICATIONS

The right is reserved to change the published specifications of equipment at any time, and to furnish merchandise in accordance with current specifications, without incurring any liability to modify equipment previously sold.

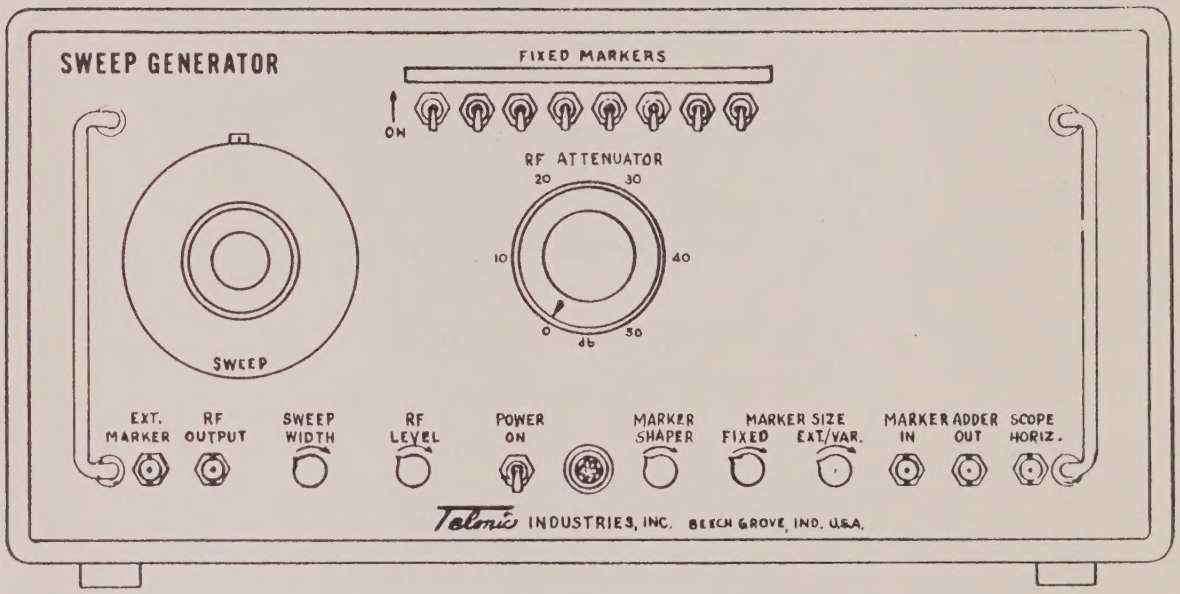
RETURNING EQUIPMENT TO FACTORY

Factory service is available for repair and readjustment of this instrument. However, a description of the trouble, plus the MODEL AND SERIAL NUMBERS of the unit should be forwarded FIRST, whereupon instructions for correcting the trouble OR authorization for returning the equipment will be given. This applies to all units, whether under warranty or not.

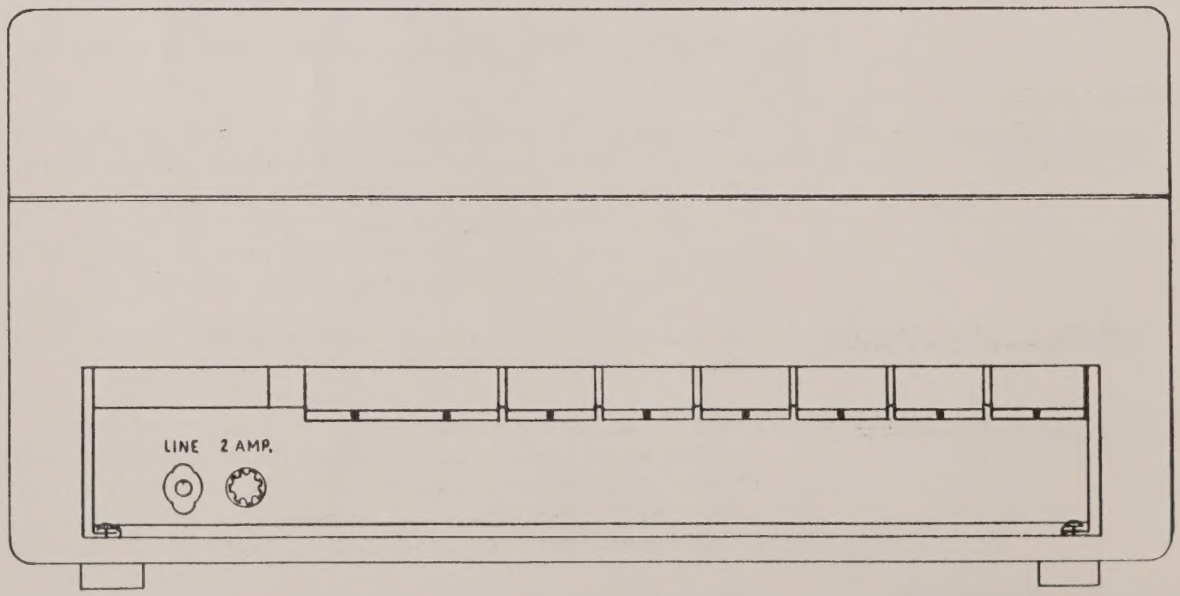
SPECIFICATIONS

MODEL HD-3 SWEEP GENERATOR

CENTER FREQUENCY	.5 to 200 MC
FREQUENCY RANGE	.5 to 300 MC
SWEEP WIDTH	200 KC to 200 MC
OUTPUT	
Voltage	0.8 volts peak to peak
Impedance	50Ω
Flatness	± 5% over maximum sweep width
ATTENUATION	
Step	0, 10, 20, 30, 40, 50 db.
Vernier	0 to over 10 db.
DISPLAY LINEARITY	Normally below 1.2:1
RADIATION	Less than 10 microvolts
SWEEP RATE	Line Frequency (50-60 cps.)
ZERO BASE LINE	Oscillator off during sweep retrace.
SCOPE HORIZONTAL SWEEP	Approximately 15 volts peak to peak.
SOURCE VSWR	Normally below 1.2:1.
POWER	115/230 Vac, 50/60 cps., Approximately 120 watts.
MARKER SYSTEM	
Birdy-By-Pass Marker Circuitry	The output of the marker oscillators is mixed with a signal from the sweep oscillator to produce beatnotes or birdies. These are amplified and superimposed upon the detected RF output signal before it is applied to the vertical scope input. Amplitude and shape of the markers are adjustable over a wide range.
External Marker Input	An external CW signal of approximately 0.1 volts may be used to produce a "birdy" type marker.
Plug-In Crystal Markers	Provisions are included for up to eight single frequency or harmonic type plug-in crystal-controlled markers. These markers are optional and may be included in this instrument or added at a later date. See our literature for further details regarding these markers.
PHYSICAL DESCRIPTION	Panel Size - 1/8" x 8 3/4" x 19". Chassis Size - 2" x 14 1/2" x 17".


SWEEP GENERATOR
FIXED MARKERS
ON
RF ATTENUATOR
20
30
10
40
0
db
50
SWEEP
EXT. MARKER
RF OUTPUT
SWEEP WIDTH
RF LEVEL
POWER ON
MARKER SHAPER
MARKER SIZE
FIXED
EXT/VAR.
MARKER IN
ADDER OUT
SCOPE HORIZ.
Telonic INDUSTRIES, INC. BEECH GROVE, IND. U.S.A.

FRONT

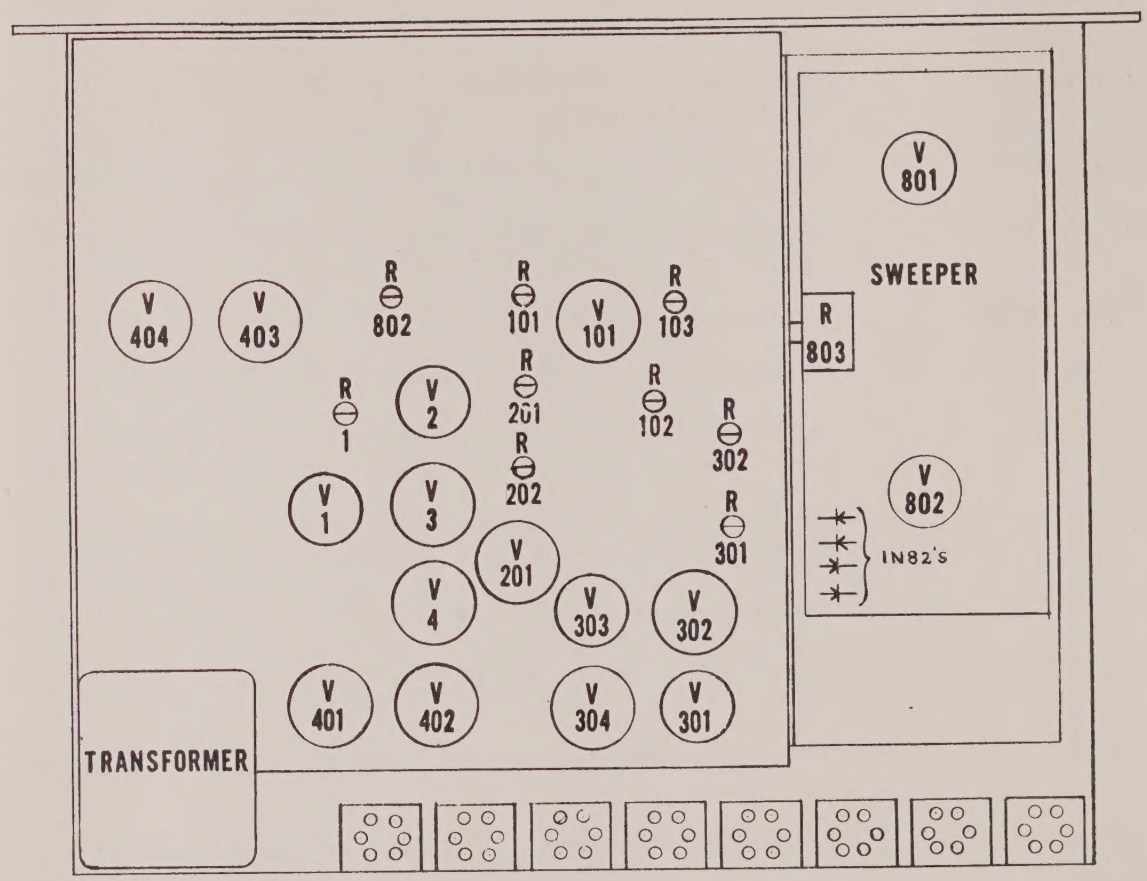

LINE
2 AMP.

REAR

DESCRIPTION OF FRONT PANEL

SWEEP DIAL	Indicates center frequency of the sweep oscillator at minimum sweep width.
RF ATTENUATOR	Turret Attenuator provides indicated amounts of attenuation.
FIXED MARKERS	These switches supply B+ to the fixed markers (crystal plug-in units) when in the ON position.
EXTERNAL MARKER	Marker input for external signal source.
RF OUTPUT	RF sweep output - BNC Connector - impedance 50 ohms.
SWEEP WIDTH	Varies the amount of voltage supplied to the vibrating capacitor and can be used to vary the sweep width.
RF LEVEL	Determines the average B+ supplied to the sweep oscillator and may be used as a vernier level control.
POWER ON	Switches AC power ON and OFF.
MARKER SHAPER	Varies the width of the marker signals.
MARKER SIZE	
FIXED	Varies the amplitude of the fixed markers (crystal plug-in units).
EXT/VAR	Varies the amplitude of the external marker signals.
MARKER ADDER	
IN	The demodulated signal from the device being tested is fed into this connector so that marker signals may be superimposed.
OUT	This connector should be connected to the vertical input terminals of the scope for viewing the demodulated signal and markers.
SCOPE HORIZONTAL	This connector should be connected to the scope horizontal amplifier input.

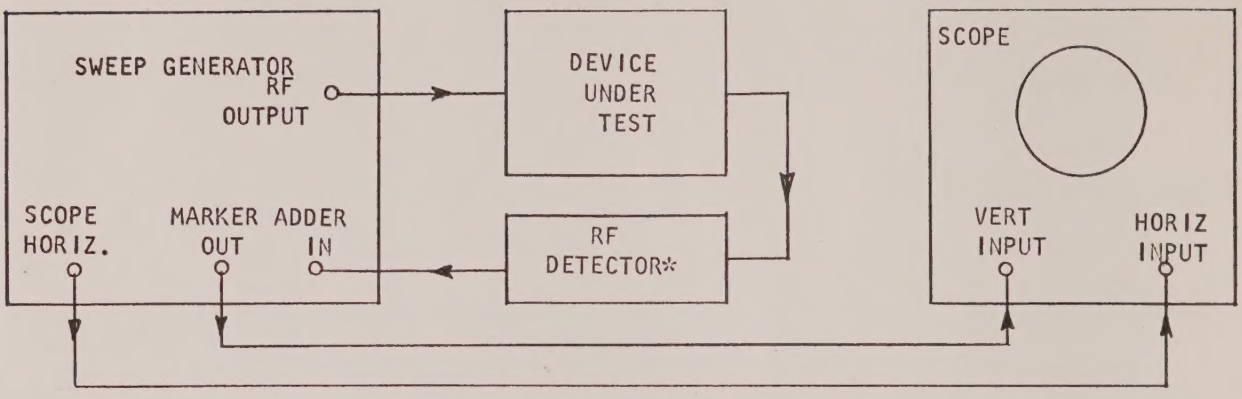
CHASSIS LAYOUT
Top View



V1	5651
V2	6AU6
V3	EL84/6BQ5
V4	EL84/6BQ5
V101	12AX7
V201	12AX7
V301	6AU6
V302	12AX7
V303	6AU6
V304	EL84/6BQ5
V401	12AX7
V402	12AX7
V403	12AX7
V404	12AX7
V801	6AF4
V802	6AF4

DESCRIPTION OF CHASSIS CONTROLS

R1 - B+ ADJUST	This control varies the bias on the amplifier, (V2), for the B+ regulator, (V3), and is adjusted to produce a regulated B+ voltage (B+2) of 175 volts.
R101 - HORIZONTAL PHASE	This control adjusts the phase of the scope horizontal sweep voltage with reference to the phase of the sweep oscillator.
R102 - LINEARITY	This control can be used to change the waveform of scope horizontal output (V101). It is normally set for best linearity at maximum sweep width.
R103 - HORIZONTAL SIZE	This control adjusts the size of the horizontal output when the Front Panel SWEEP WIDTH Control is set to its maximum position. It is adjusted to maintain a constant horizontal size at all sweep width settings.
R201 - BLANKING PHASE	This control adjusts the phase of the blanking pulse with reference to the phase of the sweep oscillator.
R202 - BLANKING WIDTH	This control is the grid resistor for the blanking pulse generator (V201). It is adjusted to blank one-half of the sweep cycle to produce a zero base line.
R301 - LEVEL MAXIMUM	This control is used to adjust the output level when the Front Panel LEVEL Control is at its maximum position.
R302 - LEVEL MINIMUM	This control is used to adjust the output level when the Front Panel LEVEL Control is at its minimum position.
R802 - SWEEP WIDTH LIMIT (HI FREQ. SIDE OF DISPLAY) R803 - SWEEP WIDTH LIMIT (LO FREQ. SIDE OF DISPLAY)	These limit controls determine the voltage supplied to the Front Panel sweep width dual potentiometer and are used to adjust the sweep width when the Front Panel Control is set to maximum. The two sweep oscillators are operating out of phase with each other and the nonlinearities present at such wide sweeps cancel out. Thus the two limit controls are set not only to provide full sweep width but are also set for best display linearity. R802 affects primarily the high frequency side of the display and R803 affects primarily the low frequency side of the display.



TYPICAL SET UP - The following procedure is recommended for setting up this instrument in test position.

1. Connect unit to proper power line voltage and turn POWER ON switch to ON position.

2. Make connections to the scope, the device under test, and RF Detector as shown above. All connectors located on the sweep generator are BNC type and it is recommended that RG cable be used for all connections. This insures good ground connection between each device, minimizes hum, leakage from unit and pick up of spurious external signals. The cable that is used to connect the RF OUTPUT to the device under test should match the impedance of the sweep generator. If the input impedance of the device under test is different than the impedance of the sweep generator, a matching network should be used to insure a constant input signal.

3. Adjust the RF output level by means of the OUTPUT LEVEL control and the step RF ATTENUATOR to the proper input signal for the device being tested. Failure to do this will result in a misleading scope pattern.

4. Adjust the SWEEP WIDTH control and center frequency SWEEP DIAL to cover the desired frequency range.

5. MARKERS
   Markers may be produced by one or more of the following methods depending on the specific unit.
   A. Plug-in crystal markers (C type).
   B. Plug-in crystal harmonic markers (CDH or CH type).
   C. Internal variable marker.
   D. External C.W. Signal.
   First turn on marker unit or inject external C.W. signal and adjust MARKER SIZE and SHAPER until markers are of a convenient size and width.

*See Telonic literature for detector recommended for use with this instrument.

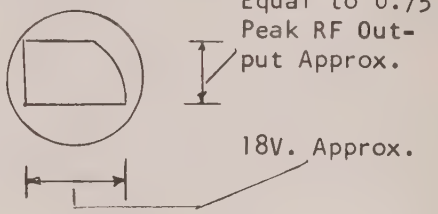
INTERNAL CONTROL ADJUSTMENT

PRINTED WIRING BOARD CONTROLS are adjusted at the factory and normally do not require any readjustment. However, should it be desirable to check these adjustments, follow these steps.

1-Connect unit as shown under operating instructions but omit the device under test. The recommended detector for the unit is the Telonic XD-3A. Turn unit on.

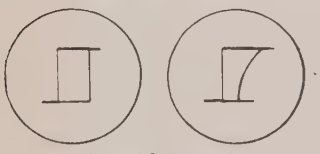
2-B+2 ADJUSTMENT: Adjust R1 to provide a regulated B+ voltage of 175 volts (blue wire).

3-BLANKING PHASE and WIDTH ADJUSTMENTS: Set SWEEP WIDTH Control to its maximum counter-clockwise position; OUTPUT LEVEL Control to its maximum clockwise position and the Attenuator to its 0 db. position. The "normal" pattern which should appear on the oscilloscope may be nearly rectangular, may have a rounded upper right corner as shown in the sketch to the right, or may be between the two in appearance.



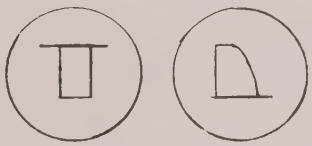
Adjust SCOPE VERTICAL and HORIZONTAL SENSITIVITY Controls to present a "normal" pattern. Vertical amplifier should be d-c coupled, pattern will deflect up or down depending on output polarity of the r-f Detector. Patterns shown with Telonic XD-3A half-wave detector with negative output.
A vertical line indicates no horizontal output; first check scope and connecting cables, then trouble-shoot horizontal sweep section.
A horizontal line with zero amplitude indicates no r-f output. First check scope, r-f detector and connecting cables. Adjust R301 (see step 4). Refer to Maintenance, Page 13.
A horizontal line deflected below zero indicates no blanking. Trouble-shoot the blanking generator.
If pattern is not normal, adjust BLANKING WIDTH and PHASE Controls R201 and R202. Shown below are some patterns which may be observed when these controls are misadjusted.

BLANKING PHASE



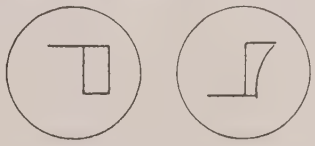
Misadjusted

BLANKING WIDTH



Misadjusted

BLANKING PHASE & WIDTH



Misadjusted

4-RF OUTPUT MIN and MAX ADJUSTMENTS: Adjust LEVEL MAXIMUM Control R301 until vertical height of the pattern equals 0.3 volts (this reading corresponds to a peak RF output of 0.4 volts since the detector efficiency is approximately 75%. Turn Turret Attenuator to 10 db. position and record the height of the pattern. Return the Turret Attenuator to the 0 db. position. Turn the RF OUTPUT LEVEL Control to its maximum counter-clockwise position and adjust LEVEL MINIMUM Control, R302, until the height of the pattern is slightly less than it was with 10 db. inserted in the output circuit. This procedure insures that the OUTPUT LEVEL Control will provide over 10 db. of vernier attenuation. An alternate method to perform the above adjustments is to use an r-f power meter in place of the r-f Detector. Keep in mind that the sweep oscillator is blanked off for 1/2 of each cycle, therefore, the reading on the power meter will have to be doubled to obtain the acutal r-f output power.

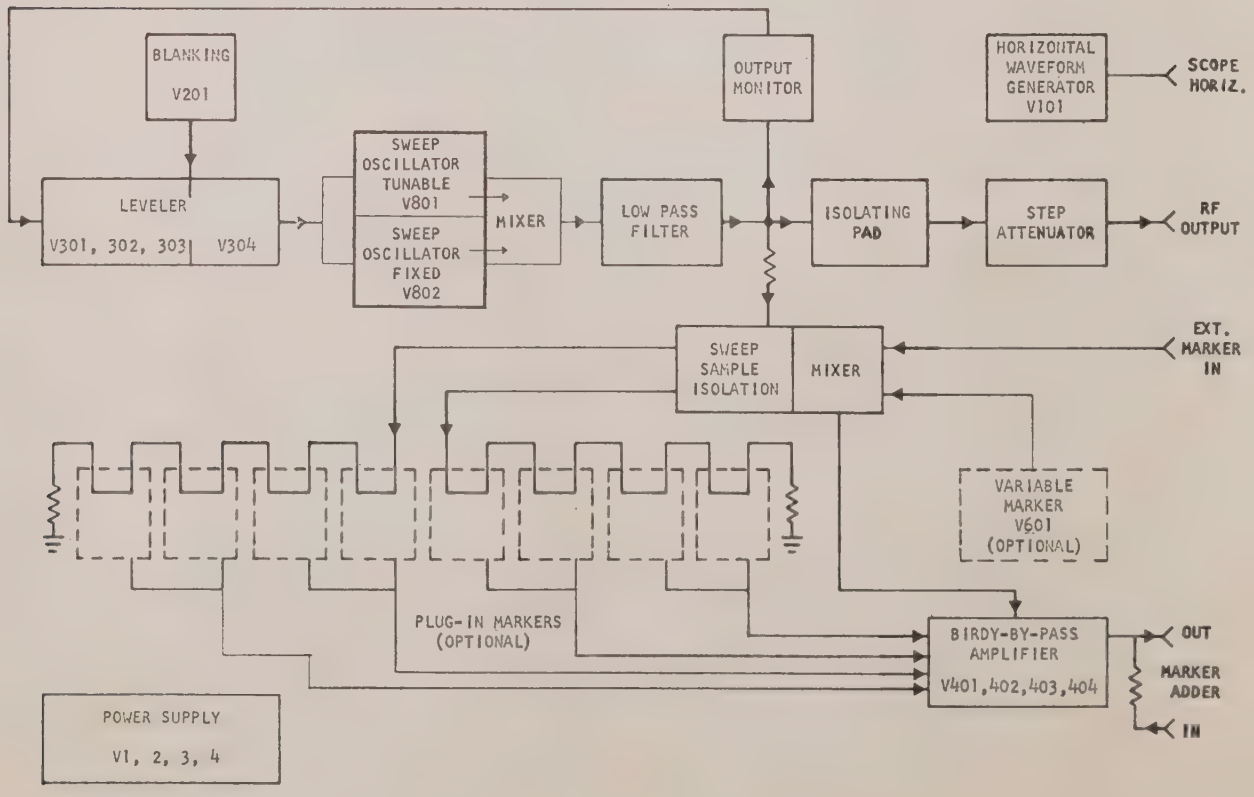
5-HORIZONTAL PHASE and SIZE ADJUSTMENTS: Return OUTPUT LEVEL Control to maximum clockwise position. Set SWEEP WIDTH Control to its maximum clockwise position. If pattern is not normal, adjust HORIZONTAL PHASE, R101. If horizontal size has increased or decreased, adjust HORIZONTAL SIZE, R103, until pattern has the same horizontal size as it had with the SWEEP WIDTH Control in its counter-clockwise position.

MARKERS MUST BE PROVIDED FOR THE FOLLOWING ADJUSTMENTS

6-SWEEP WIDTH ADJUSTMENT: With the Sweep Dial set to a center frequency of 200 Mc, R802 is adjusted so that the highest frequency obtained on the display is 300 Mc. R803 is next adjusted so that the lowest frequency present on the display is 100 Mc.

7-LINEARITY ADJUSTMENT: Linearity may best be adjusted when a number of markers are present on the display. In the factory a harmonic generator is used for this purpose. The LINEARITY Control, R102, is adjusted for equal spacing between the markers. The HORIZONTAL PHASE Control also has an effect on linearity and can be adjusted slightly to obtain optimum linearity.

BLOCK DIAGRAM



SWEEP OSCILLATOR

The sweep output is produced by the heterodyne method which combines the output of a tunable Sweep Oscillator with a second fixed tuned sweep oscillator. These two sweep oscillators are swept 180° out of phase which accounts for the wide sweep width since the sweep width of each sweep oscillator is added in the heterodyne output. This method of sweeping also produces excellent linearity since the non-linearities of each sweep oscillator are canceled in the heterodyne output.

Four diodes in a bridge circuit produce the mixing of the two fundamental frequencies and due to the balanced nature of this mixer, a high output is produced with a minimum of harmonic or spurious content. A low pass filter removes the fundamental frequencies and allows the output or heterodyne frequencies to pass out through the monitor and attenuator to the final output. The oscillator circuits are similar and have similar frequency versus voltage or frequency versus temperature effects to minimize drifts.

BLANKING CIRCUIT

The purpose of the blanking circuit is to produce a zero base line by removing B+ from the Sweep Oscillator during the sweep retrace. The blanking voltage is originated by a square wave producing circuit. A phased 6.3 volt sinewave is squared and amplified by the blanking tube. This square wave output of V201 controls V304 (EL84), the sweep oscillator voltage regulator tube, and thus deprives the Sweep Oscillator of voltage during one-half of each cycle. PHASE and WIDTH controls are provided for adjusting this blanking voltage to coincide with the horizontal and sweep drive signals.

AUTOMATIC OUTPUT LEVELING CIRCUITRY

A sample of the sweep oscillator output is detected by the monitor diode, located in the monitor block. This detected signal is then amplified and used to control the plate voltage of the sweep oscillator. The OUTPUT LEVEL control adjusts the bias on the first stage of the amplifier. This causes the DC levels in the entire amplifier to change, and varies the average B+ supplied to the sweep oscillator from a minimum of 25V to over 100V. A small decrease in the sampling voltage causes a large increase in the B+ supplied to the sweep oscillator, and thus counteracts any amplitude variation as the oscillator is tuned over the range.

The operation of this circuit and of the sweep oscillator can be checked at Pin 1 of V301. The waveform at this point will normally show a flat output level over the entire band. Adjusting the OUTPUT LEVEL will change this level.

To replace the monitor diode, remove the insulated holding screw in the monitor block and then remove diode from the block.

HORIZONTAL SWEEP OUTPUT CIRCUITRY

The sawtooth voltage for the scope horizontal sweep is produced by V101. A phased 6.3 volt sinewave is applied to the grid of one of the triode sections of V101. The tube then clips and amplifies the grid signal so that a square wave is produced at the plate. This square wave is then shaped by a RC network in the plate circuit to produce a linear sawtooth voltage. A potentiometer in this circuit allows the linearity of the waveform to be adjusted. This sawtooth voltage is then applied to the second triode section of V101, which is connected as a cathode follower. The output from the cathode follower is then applied to the Scope Horizontal Amplifier and compensates for the slight nonlinear characteristics of the vibrating sweep capacitor at high sweep widths. At sweep widths from minimum to about 50%, the vibrating sweep capacitor is quite linear. In order to maintain almost perfect linearity for all values of sweep width, a potentiometer is ganged with the sweep width potentiometer which automatically changes the scope horizontal sweep voltage from a sinusoidal waveform at low sweep width settings to a linear sawtooth waveform at the high sweep width settings.

POWER SUPPLY

The power transformer output of 140 volts AC is fed into a half wave voltage doubler using silicon rectifying elements CR1 and CR2. B+ is taken off the capacity input filter to provide +375 volts unregulated to the plates of V3, (B+ Regulator Pass Tube), V304 (Oscillator Pass Tube), and V4 (Marker B+ Pass Tube).

B+2 is the output of the electronic regulator circuit, consisting of V2 and V3, and provides +175 volts regulated. Potentiometer R1 controls the operating point of V2, regulator amplifier, and is set for proper B+2 output voltage.

B+3 is obtained by biasing the grid of V4 at approximately 85 volts positive, which causes current to flow through cathode resistor R20. The voltage at Pin 3, V4, is supplied to the Plug-In Markers and maintains its regulation due to the low impedance characteristics of the cathode follower circuit and provides approximately 100 volts.

The B- voltage is obtained by the half wave Silicon rectifier CR3. Regulator tube V1 maintains this voltage at -82 volts, and supplies bias voltage to the leveler circuit as well as a reference voltage for the electronic regulator.

Resistor R4 acts as a fuse, protecting the transformer and rectifiers from overload.

The primary of the power transformer is normally wired for 115 volt AC line operation. However, it can be converted to operate from a 230 volt AC source if desired. This conversion is described in the maintenance section.

MARKER SYSTEM DESCRIPTION

GENERAL

A sample of the sweep signal is mixed with the fundamental or a harmonic of the crystal plug-in marker units or external signal to produce beatnotes or birdies. These birdies are then amplified and superimposed upon the demodulated swept signal and applied to the vertical amplifier of the oscilloscope. The size and shape of the marker may be varied over a wide range by the SIZE and SHAPER Control of the birdy amplifier.

EXTERNAL MARKER INPUT

The CW signal from the external marker input is fed into a diode mixer, where it is mixed with a sample of the sweep signal to produce birdies. The resultant birdy is then fed into the birdy-by-pass amplifier.

PLUG-IN MARKERS

This unit has provisions for a maximum of eight single-frequency (C type) crystal markers or four harmonic (CDH type), or any combination. Each CDH type marker occupies the space of two C type.

SINGLE FREQUENCY MARKERS (C TYPE)

These crystal markers are self-contained plug-in units. Additional units at other frequencies (within the range of the sweep generator) may be ordered and substituted for the original units.

The crystal oscillator units include the tube, crystal oscillator tuning, crystal diode mixer, and a tuned circuit selecting the sweep input frequency. A test point is provided for easy adjustment of the overtone crystal oscillator (this circuit used above 12 mc.). In making this adjustment, the crystal oscillator coil slug is adjusted for near maximum voltage at the test point. This is usually in the order of 2-5 volts as measured with a VTVM. The adjustment should be made just slightly off the peak on the low inductance side, since the effects of tuning are critical on the other side of the resonance curve. Crystal oscillators below 12 mc. are Pierce type oscillator circuits which require no tuning.

By tuning the sweep sample coil, the frequency of the sweep input signal can be varied and thus minimize unwanted markers generated from other harmonics of the crystal oscillator. The amplitude can be varied by adjusting the coupling.

HARMONIC MARKERS

The Telonic CDH type marker uses two tubes and occupies two of the plug-in positions on the marker strip.

In this marker unit, harmonics of the signal from a crystal-controlled oscillator are mixed with a portion of the sweep signal to produce a display of markers at regular intervals across the sweep range. Satisfactory markers are produced to over 1000 Mc in most of these units.

See our literature on plug-in markers for additional information.

POWER SUPPLY: Since a defect in the power supply will affect all circuits, it should be checked for proper operation before proceeding to other circuits.

SUPPLY	NOMINAL VALUE	NORMAL VARIATION	NORMAL RIPPLE	WIRE COLOR*
AC Line	115V	----------	------	------
B+1	375	±15 Volts	6 to 15 volts	Red
B+2	175	±.5 Volts	12 to 25 millivolts	Blue
B+3	100	±5-10 Volts	15 millivolts to .5 volts	Orange
B-	-82	±2 Volts	100 millivolts	White
6.3 "A"	6.3V AC	Main filament supply		Green
6.3 "B"	6.3V AC	180° out of phase with supply "A". Source of phasing and filament voltages.		Gray
6.3 "C"	6.3V AC	Isolated filament voltage for tubes with cathodes above ground.		Brown

NEXT: If power supply is operating normal, use the block diagram to isolate the trouble to a major section. Check tubes, diodes, and adjustment of Front Panel and printed wiring board controls located within that section (see Page 7 for adjustment procedure). By the use of the schematic, ordinary difficulties encountered can be readily located and remedied. The following trouble-shooting chart is an additional aid to servicing:

SYMPTOM	POSSIBLE CAUSE AND REMEDIES
Pilot Light Off and Unit Fails to Operate	Fuse open - replace. If second fuse opens - look for cause of overload, shorted wiring, components, etc.
B+1 Off Value or Excessive Ripple	Check R4, C1, C2, CR1, and CR2.
B+2 Off Value or Excessive Ripple	Check R1 for proper adjustment. Check R15, it will burn out if B+2 is overloaded. Check V1, V2, V3, tubes and circuitry.
B+3 Off Value or Excessive Ripple	Check R17 and R21 (these resistors adjust the voltage on the grid of V4, a cathode follower, which in turn determines the voltage on the cathode). Check R18 (this resistor will burn out if B+3 is overloaded). Check V4 and C2.
B- Off Value or Excessive Ripple	Check C3, C4, C5, CR3, R3, R5, and R6. Check V1 to see if it is lit properly (should be a steady orange glow).

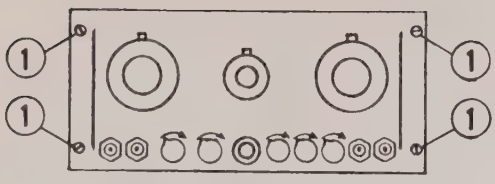
*Wire colors do not apply to shielded wires - single wires only.

V1 Not Lit Properly	If replacing V1 and checking the above parts does not remedy the trouble, check the line voltage. Low line voltage could cause this trouble. Reducing the value of R3 slightly will usually eliminate this difficulty.
RF Output is Low or Zero	Check R314 - this resistor will burn out if the B+ to the Sweep Oscillator is overloaded. Check B+ to the Sweep Oscillator, cathode of V304. It should be a positive square wave of 25-100 volts and should vary as the OUTPUT LEVEL control varies. If it is normal, look for RF difficulties, defective tube, components, shorted or open wiring, etc. Replace mixer diodes in sweeper box, observe polarity. If the voltage is low and does not respond to the LEVEL control, remove first V303 and then V201. When either of these tubes conducts, the voltage on the grid of V304 (pin 2) is reduced and thus decreases the B+ to the Sweep Oscillator. If removal of V201 allows the B+ on V304 (pin 3) to return to normal, check the blanking tube, controls, and associated circuitry. If removal of V303 causes the B+ to return to normal, check the LEVELER controls, V301 and V302, tubes, and associated circuitry.
Poor Leveling	Replace monitor diode. Also replace V301, V302, and V303. V301 is the most critical since it is in the first stage of the DC coupled amplifier. Resetting the printed circuit LEVEL controls is sometimes necessary if these tubes are replaced.
Weak Markers	Replace IN82 or IN34 crystal diode mixer. Check Birdy-By-Pass Amplifier, tubes and circuitry.
No Horizontal Output	Look for difficulty in the sawtooth circuitry V101, using the printed circuit board layout and schematic to check waveforms and voltages.

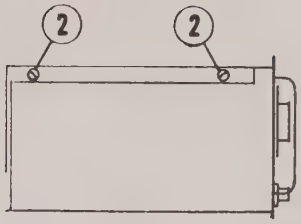
CONVERSION FOR 230 VOLT POWER LINES

The dual primary of the power transformer is normally wired in parallel for use with 115 volt AC lines. The windings can easily be reconnected in series for use with 230 volt power. With the aid of the Chassis Layout, bottom view, locate terminals 1, 2, 3 and 4. Remove the jumper wires from terminals 1 and 2 and terminals 3 and 4. Connect a jumper wire between terminals 2 and 3. Remove the 2 amp fuse (F1) and replace with a 1 amp Slo-Blo fuse.

RACK MOUNTED UNIT



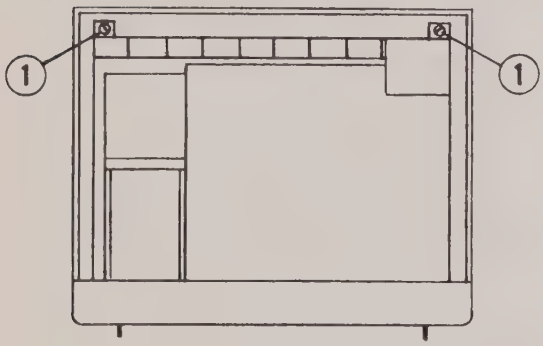
FRONT



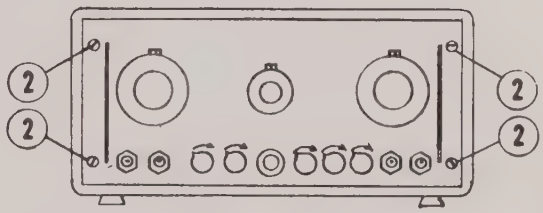
SIDE

Unit has front panel slotted or drilled for standard RTMA Mounting. Position unit in rack and install mounting screws in holes marked 1.
Dust cover removal: Remove four #8-32 thread-cutting screws, marked 2 (two on each side) and lift off cover for easy access to chassis.

CABINET MOUNTED UNIT



TOP



FRONT

To remove chassis from cabinet; first remove the two #8-32 screws (marked 1 on top view above) at the back of the chassis (one on each side). These screws fasten the chassis to the cabinet guide rails. Second, remove the four #10-32 screws (marked 2 in front view above). The screws hold the panel to the cabinet.

Slide chassis out of cabinet by pulling forward on the two front panel handles.

To replace chassis in cabinet, insert the flanges on the bottom of the chassis side panels into the slot of the cabinet guide rails. Push chassis back into cabinet far enough for the slots in the side panel flanges to align with the retained nut in guide rail. Install the two #8-32 screws and tighten securely. Replace the four #10-32 screws in the front panel.

PART VALUE INFORMATION

SCHEMATIC PART DESIGNATION	
C	Capacitor
CR	Crystal Rectifier, Germanium Diode
F	Fuse
I	Incandescent Pilot Light
J	Jack or termination, Coaxial Connector
K	Cable
L	Coil
M	Meter or Motor
P	Plug, Coaxial Connector
R	Resistor, Fixed or Variable
S	Switch
T	Transformer
V	Tube
Z	Miscellaneous

SCHEMATIC VALUE ABBREVIATION	
Ω	ohms
K Ω	1,000 ohms
M Ω	1,000,000 ohms (megohms)
µf, uf	Microfarad
pf	Picofarad
µh, uh	Microhenry
mh	Millihenry

RESISTORS - All resistors are 1/2 watt ± 10%, and are shown in ohms, unless otherwise specified.

NOTE: Resistors in the attenuator pads are ± 2%.

CAPACITORS - All Capacitors are shown in picofarads (pf) unless otherwise specified.

COILS - All coils are shown in microhenries (µh) unless otherwise specified.

PARTS LOCATION - F.P. Front Panel
P.C.B. Printed Circuit Board
R.P. Rear Panel
C.H. Chassis
T.P. Test Point

PARTS NUMBERS - LOCATION INFORMATION

1 - 99 - Power Supply
101 - 199 - Horizontal and Alternate Sweep Drive Circuit
201 - 299 - Blanking
301 - 399 - Leveler
401 - 499 - Birdy-By-Pass
501 - 599 - Mixer & Plug-In Markers
601 - 699 - Variable Markers
701 - 799 - Attenuators
801 - 899 - Sweep Oscillator and Sweep Drive Circuit
901 - 999 - Modifications and Special Circuits

*Indicates value of component adjusted at factory, and may deviate from value shown on print.

—○— 16 Indicates printed circuit board terminal.

N O T I C E

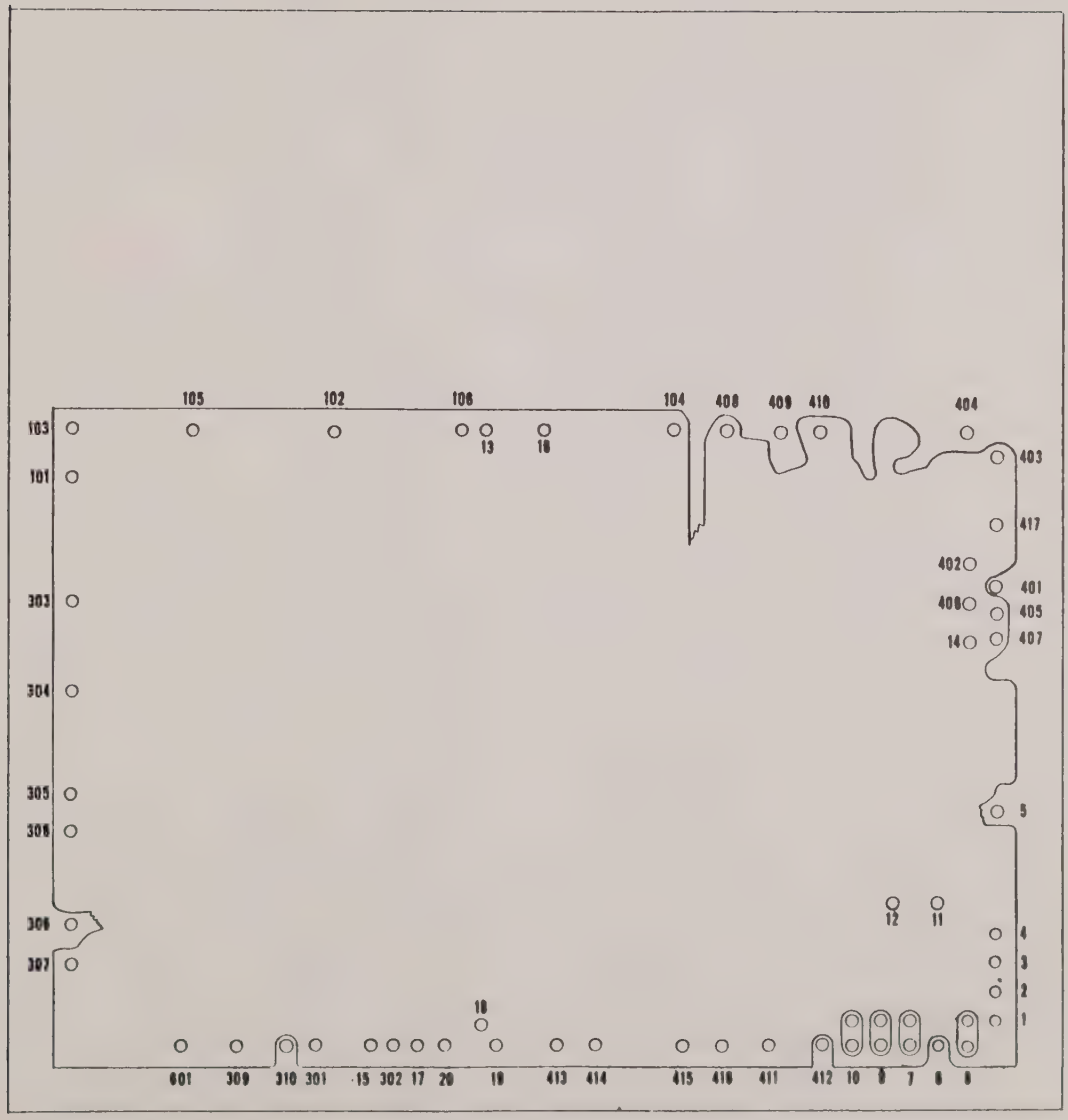
RED LACQUER IS USED TO INDICATE FASTENINGS THAT SHOULD NOT BE DISTURBED FOR ORDINARY SERVICE, AND TO SECURE ADJUSTABLE CONTROLS.

CHASSIS LAYOUT

BOTTOM VIEW

TERMINALS

FRONT



804

PARTS LIST

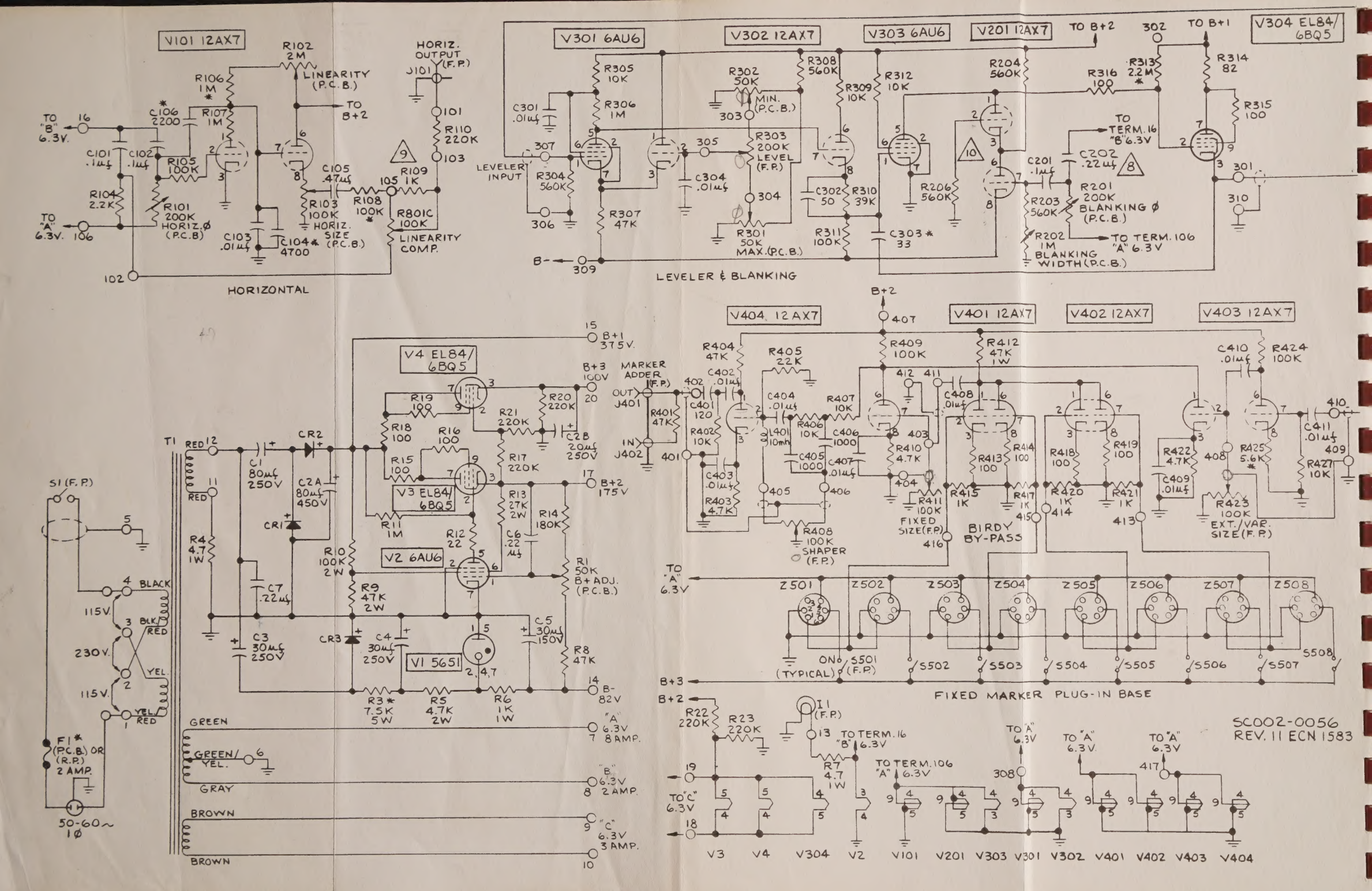
Circuit Ref.	Description	Telonic Part No.
C1	CFE, 80μf, 250 VDCW	C-314
C2	CFE, 80/20μf, 450/250 VDCW	C-308
C3	CFE, 30μf, 250 VDCW	C-313
C4	Same as C3	
C5	CFE, 30μf, 150 VDCW	C-312
C6	CFP, 0.22μf, ±20%, 400 VDCW	C-217
C7	Same as C6	
C101	CFP, 0.1μf, ±20%, 200 VDCW	C-203
C102	Same as C101	
C103	CFP, 0.01μf, ±20%, 600 VDCW	C-210
C104	CFM,4700pf, ±10%, 500 VDCW (SC)	C-54
C105	CFP, 0.47μf, ±20%, 200 VDCW	C-216
C106	CFM, 2200pf, ±10%, 500 VDCW (SC)	C-24
C201	Same as C101	
C202	Same as C101	
C301	CFC, 0.01μf, +80-20%, 500 VDCW	C-20
C302	CFC, 50pf, ±10%, 1000 VDCW	C-11
C303	CFC, 33pf, ±10%, 1000 VDCW (SC)	C-10
C304	Same as C301	
C401	CFC, 120pf, ±10%, 600 VDCW	C-14
C402	Same as C301	
C403	Same as C301	
C404	Same as C301	
C405	CFC, 1000pf, GMV, 1000 VDCW	C-19
C406	Same as C405	
C407	Same as C301	
C408	Same as C301	
C409	Same as C301	
C410	Same as C301	
C411	Same as C301	
C501	CFCF, 1000pf, GMV, 1000 VDCW	C-39
C801	CFCF, 1000pf, +100-0%, 500 VDCW	C-110
C802	Same as C801	
C803	Same as C801	
C804	Same as C801	
C805	Same as C801	
C806	Same as C801	
C807	Same as C801	
C808	CFC, 4pf, ±5%, 500 VDCW	C-41
C809	Same as C808	
C810	CFN, 0.43pf, ±10%, 500 VDCW	C-58
C811	CFM, 400pf	NA
C812	Same as C801	
C813	Same as C801	
C814	Same as C801	
C815	Same as C801	
C816	Same as C801	
C817	Same as C801	
C818	CFN, 3pf, ±10%, 500 VDCW (SC)	C-34
C819	Same as C301	
C820	CFE, 100μf, 12 VDCW (SC)	C-319
C821	Same as C820	
CR1	DS, 1N2094	D-7
CR2	Same as CR1	
CR3	Same as CR1	
CR501	DS, 1N82	D-1
CR801	DS, 1N218	D-3
CR802	Same as CR501	
CR803	Same as CR501	
CR804	Same as CR501	
CR805	Same as CR501	
F1	Fuse, 3AG, 2a, 250V	MP-6
I1	LI, #47	MP-5
J101	RJ, Dage type 2545-1	J-10
J401	Same as J101	
J402	Same as J101	
J501	TC, MX-1684/U	J-9
J502	Same as J501	
J503	Same as J501	
J504	Same as J501	
J505	JC, Dage type 2559-1	J-11
J506	JRTA	
J507	Same as J506	
J701	RJ, Dage type 9954-1	J-40
J702	Same as J701	
J703	JC, Dage type 2559-1	J-11
J801	RJ, UG-185/U	J-3
J802	RJ, UG-535/U	J-6
J803	Same as J801	
J804	RJ, UG-2618/U	J-16
J805	TC, MX-1530/U	J-8
J806	Same as J805	
L401	IV, 6-11mh	L-23
L801	IF, 0.3μh	L-104
L802	IF, 2.2μh	L-101
L803	Same as L802	
L804	Same as L802	
L805	IF, 0.6μh	L-29
L806	IF (SC)	09008
L807	Same as L801	
L808	Same as L802	
L809	Same as L802	
L810	Same as L805	
L811	IF (SC)	09009
L812	IF (SC)	09007
L813	IF (SC)	09006
L814	IV (SC)	09003
L815	IF, 0.68μh	L-103

Circuit Ref.	Description	Telonic Part No.
P506	PC, UG-88B/U	J-32
P507	Same as P506	
P701	Same as P506	
P702	Same as P506	
P801	Same as P506	
P802	Same as P506	
P803	Same as P506	
P804	Same as P506	
R1	RVC, 50KΩ, 0.2W	R-725
R2	NA	
R3	RFW, 10KΩ, ±10%, 5W (SC)	R-404
R4	RFC, 4.7Ω, ±10%, 1W	R-206
R5	RFC, 4.7KΩ, ±10%, 2W	R-306
R6	RFC, 1KΩ, ±10%, 1W	R-208
R7	Same as R4	
R8	RFC, 47KΩ, ±10%, 1/2W	R-27
R9	RFC, 47KΩ, ±10%, 2W	R-305
R10	RFC, 100KΩ, ±10%, 2W	R-303
R11	RFC, 1MΩ, ±10%, 1/2W	R-31
R12	RFC, 22Ω, ±10%, 1/2W	R-11
R13	RFC, 27KΩ, ±10%, 2W	R-304
R14	RFC, 180KΩ, ±10%, 1/2W	R-45
R15	RFC, 100Ω, ±10%, 1/2W	R-15
R16	Same as R15	
R17	RFC, 220KΩ, ±10%, 1/2W	R-44
R18	Same as R15	
R19	Same as R15	
R20	Same as R17	
R21	Same as R17	
R22	Same as R17	
R23	Same as R17	
R101	Same as R101	
R102	RVC, 2MΩ, 0.2W	R-729
R103	RVC, 100KΩ, 0.2W	R-732
R104	RFC, 2.2KΩ, ±10%, 1/2W	R-20
R105	RFC, 100KΩ, ±10%, 1/2W	R-28
R106	RFC, 560KΩ, ±10%, 1/2W	R-29
R107	Same as R11	
R108	Same as R105	
R109	Same as R7	
R110	Same as R17	
R201	RVC, 200KΩ, 0.2W	R-724
R202	RVC, 1MΩ, 0.2W	R-728
R203	Same as R106	
R204	Same as R106	
R205	Same as R106 (SC)	
R206	Same as R106	
R301	Same as R1	
R302	Same as R1	
R303	RVC, 200KΩ, 1/4W	R-707
R304	Same as R106	
R305	RFC, 10KΩ, ±10%, 1/2W	R23
R306	Same as R11	
R307	Same as R8	
R308	RFC, 680KΩ, ±10%, 1/2W	R-30
R309	Same as R305	
R310	RFC, 39KΩ, ±10%, 1/2W	R-26
R311	Same as R105	
R312	Same as R305	
R313	Same as R11	
R314	RFC, 82Ω, ±10%, 1/2W	R-54
R315	Same as R18	
R316	Same as R18	
R401	Same as R8	
R402	Same as R105	
R403	RFC, 4.7KΩ, ±10%, 1/2W	R-21
R404	Same as R8	
R405	RFC, 22KΩ, ±10%, 1/2W	R-24
R406	Same as R305	
R407	Same as R305	
R408	RVC, 100KΩ, 1/3W	R-705
R409	Same as R105	
R410	Same as R403	
R411	Same as R408	
R412	RFC, 47KΩ, ±10%, 1W	R-210
R413	Same as R15	
R414	Same as R15	
R415	RFC, 1KΩ, ±10%, 1/2W	R-18
R416	NA	
R417	Same as R415	
R418	Same as R15	
R419	Same as R15	
R420	Same as R415	
R421	Same as R415	
R422	Same as R403	
R423	Same as R408	
R424	Same as R105	
R425	RFC, 5.6KΩ, ±10%, 1/2W	R-22
R426	NA	
R427	Same as R305	
R501	RFC, 220Ω, ±10%, 1/2W	R-39
R502	RFC, 470Ω, ±10%, 1/2W	R-42
R503	RFC, 56Ω, ±5%, 1/2W	R-53
R504	Same as R503	
R505	RFC, 120Ω, ±10%, 1/2W	R-16
R506	Same as R505	
R507	RFC, 56Ω, ±10%, 1/2W (PO J506)	R-13
R508	Same as R507 (PO J507)	
R801	RVW/W/C, 6Ω, 2W/6Ω, 2W/100KΩ, 1/3W	R-735A
R802	RVW, 25Ω, 2W	R-713
R803	Same as R802	
R804	RFW, 7.5Ω, 5W	R-403
R805	RFC, 330Ω, ±10%, 1/2W	R-17
R806	RFC, 17.6Ω, ±2%, 1/2W	R-1101
R807	RFC, 292Ω, ±2%, 1/2W	R-1102
R808	Same as R806	
R809	Same as R505	

Circuit Ref.	Description	Telonic Part No.
R810	Same as R425	
R811	RFC, 180Ω, ±10%, 1/2W	R-52
R812	Same as R505	
R813	Same as R403	
R814	Same as R804	
R815	Same as R505	
S1	SWT, SPST	SW-10
S501 - S508	Same as S1	
T1	TP	T-9A
V1	TE, 5651	VT-17
V2	TE, 6AU6	VT-5
V3	TE, EL84/6BQ5	VT-16
V4	Same as V3	
V101	TE, 12AX7	VT-13
V201	Same as V101	
V301	Same as V2 (SC)	
V302	Same as V101	
V303	Same as V2	
V304	Same as V3	
V401	Same as V101	
V402	Same as V101	
V403	Same as V101	
V404	Same as V101	
V801	TE, 6AF4A or 6DZ4	VT-4/VT-51
V802	Same as V801	
Z501 - Z508	Socket, 6 pin	S-11
Z701	Attenuator, turret	05001
Z801	Wobbulator	09001
Z802	Wobbulator	09002
Z803	Filter, lo-pass	06001
	Fuseholder	S-27
	Socket, diode (5 required)	S-9
	Socket, 7-pin (7 required)	S-7
	Socket, 7-pin (4 required)	S-4
	Socket, 9-pin (10 required)	S-5

HD-3
ABBREVIATION CODE

CFC	Capacitor, fixed, ceramic
CFCF	Capacitor, fixed, ceramic feed-thru
CFE	Capacitor, fixed, electrolytic
CFM	Capacitor, fixed, mica
CFMY	Capacitor, fixed, mylar
CFN	Capacitor, fixed, composition
CFP	Capacitor, fixed, paper
IF	Inductor, fixed
IV	Inductor, variable
JRTA	Jack, resistive, terminator assembly
NA	Not assigned
PC	Plug, cable
PO	Part of
RFC	Resistor, fixed, composition
RFW	Resistor, fixed, wire-wound
RJ	Receptacle, jack
RVC	Resistor, variable, composition
RVW	Resistor, variable, wire-wound
SC	Subject to change
SWT	Switch, toggle
TC	Terminator, cable
TE	Tube, electron
TP	Transformer, power


V101 12AX7
R102 2M
LINEARITY (P.C.B.)
R106 1M
R107 1M
TO B+2
HORIZ. OUTPUT (F.P.)
J101
TO "B" 6.3V.
C106 2200
C101 .1μf
C102 .1μf
R105 100K
R104 2.2K
R101 200K HORIZ.Ø (P.C.B)
TO "A" 6.3V.
106
C103 .01μf
C104* 4700
C105 .47μf
R103 100K HORIZ. SIZE (P.C.B.)
R108 100K*
105
R109 1K
R801C 100K
LINEARITY COMP.
101
R110 220K
103
102
HORIZONTAL
V301 6AU6
V302 12AX7
V303 6AU6
V201 12AX7
TO B+2
302
TO B+1
V304 EL84/ 6BQ5
R305 10K
R306 1M
C301 .01μf
307
LEVELER INPUT
306
R304 560K
R307 47K
B-
309
R302 50K MIN. (P.C.B.)
303
305
C304 .01μf
R303 200K LEVEL (F.P.)
304
R301 50K MAX.(P.C.B.)
R308 560K
R309 10K
C302 50
R310 39K
R311 100K
R312 10K
C303* 33
R204 560K
R206 560K
R316 100
R313 2.2M*
R314 82
R315 100
TO TERM. 16 "B" 6.3V
C201 .1μf
C202 .22μf
R203 560K
R201 200K BLANKING Ø (P.C.B.)
R202 1M BLANKING WIDTH (P.C.B.)
TO TERM. 106 "A" 6.3V
301
310
LEVELER & BLANKING
B+2
407
V404 12AX7
V401 12AX7
V402 12AX7
V403 12AX7
R404 47K
R405 22K
R409 100K
R412 47K 1W
C410 .01μf
R424 100K
C402 .01μf
402
C404 .01μf
R407 10K
C408 .01μf
412 411
C401 120
R402 10K
L401 10mh
R406 10K
C406 1000
C405 1000
C407 .01μf
403
R410 4.7K
404
C403 .01μf
R403 4.7K
405
406
R408 100K SHAPER (F.P.)
R411 100K FIXED SIZE (F.P.)
416
BIRDY BY-PASS
R415 1K
R417 1K
415
R413 100
R414 100
R418 100
R419 100
R420 1K
414
R421 1K
413
R422 4.7K
C409 .01μf
C411 .01μf
410
409
R427 10K
408
R425 5.6K*
R423 100K EXT./VAR. SIZE (F.P.)
401
MARKER ADDER (F.P.)
OUT J401
IN J402
R401 47K
TO "A" 6.3V
Z501
Z502
Z503
Z504
Z505
Z506
Z507
Z508
ON/ (TYPICAL)
S501 (F.P.)
S502
S503
S504
S505
S506
S507
S508
B+3
FIXED MARKER PLUG-IN BASE
V4 EL84/ 6BQ5
B+1 375V.
B+3 100V
20
R19 100
R20 220K
R21 220K
C2B 20μf 250V
R18 100
R16 100
R15 100
V3 EL84/ 6BQ5
R17 220K
17
B+2 175V
R11 1M
R12 22
R13 27K 2W
R14 180K
C6 .22 μf
V2 6AU6
R10 100K 2W
R9 47K 2W
R1 50K B+ ADJ. (P.C.B.)
C5 30μf 150V
V1 5651
R8 47K
14
B- 82V
R3* 7.5K 5W
R5 4.7K 2W
R6 1K 1W
T1
RED 12
11
RED
CR2
CR1
CR3
C1 80μf 250V
C2A 80μf 450V
C3 30μf 250V
C4 30μf 250V
C7 .22μf
R4 4.7 1W
S1 (F.P.)
5
4
BLACK
115V.
3
BLK/ RED
230V.
YEL.
2
115V.
1
YEL/ RED
F1* (P.C.B.) OR (R.P.) 2 AMP.
50-60~ 1Ø
GREEN
"A" 6.3V 7 8AMP.
GREEN/ YEL.
6
GRAY
"B" 6.3V 8 2 AMP.
BROWN
"C" 6.3V 3 AMP.
BROWN
10
I1 (F.P.)
13
TO TERM. 16 "B" 6.3V
R7 4.7 1W
R22 220K
R23 220K
19
TO "C" 6.3V
18
TO TERM. 106 "A" 6.3V
308
417
V3
V4
V304
V2
V101
V201
V303
V301
V302
V401
V402
V403
V404
SC002-0056
REV. 11 ECN 1583

ADDENDUM SHEET

MODEL HD-3/HD-3M SWEEP GENERATOR INSTRUCTION MANUAL

The following shall be considered a part of this manual.

Page 19, Parts List:

Circuit Reference C202:
Under Description - change from: Same as C101
to read: Same as C6

Circuit Reference L815:
Under Description - change from: 1F, 0.68µh
to read: 1µh

Circuit Reference R3:
Under Description - change from: RFW, 10KΩ, ±10%, 5W (SC)
to read: 7.5KΩ, ±5%, 5W
Under Telonic Part No. - change from: R-404
to read: R-406

Circuit Reference R108:
Under Description - change from: Same as R105
to read: RFC, 100KΩ, ±10%, 1/2W
Under Telonic Part No. Add: R-28

Circuit Reference R205:
Under Description - change from: Same as R106 (SC)
to read: Deleted

Circuit Reference R308:
Under Description - change from: RFC, 680KΩ, ±10%, 1/2W
to read: Same as R106

Circuit Reference R311:
Under Description - change from: Same as R105
to read: Same as R108

Circuit Reference R313:
Under Description - change from: Same as R11
to read: RFC, 2.2MΩ, ±10%, 1/2W
Under Telonic Part No. - Add: R-34

Circuit Reference R402:
Under Description - change from: Same as R105
to read: Same as R108

Circuit Reference R409:
Under Description - change from: Same as R105
to read: Same as R108

Circuit Reference R424:
Under Description - change from: Same as R105
to read: Same as R108

Add: Circuit Reference R509:
Under Description - Add: Same as R505